

VOSSELEDONE CHARRUA: A NEW PATAGONIAN CEPHALOPOD (OCTOPODIDAE) WITH NOTES ON RELATED GENERA

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ABSTRACT

A new octopodan genus, *Vosseledone*, and its type species, *Vosseledone charrua*, is described from the Patagonian Province. The new taxon is characterized by the possession of a degenerate radula and a well developed ink sac. Its position in reference to the closely related genera is reviewed.

In the course of a study of the coastal Cephalopoda of Brasil, I encountered seven specimens which represent a new genus of incirrate octopods with uniserial suckers that occurs in the southwest Atlantic Ocean. I have examined three specimens from a collection kindly loaned by E. C. Rios of the Museu Oceanografico de Rio Grande, Rio Grande do Sul, Brazil. Four additional specimens had been sent to G. L. Voss, University of Miami, by Z. de Castellanos of the Instituto de Biología Marina, Mar del Plata, Argentina, originally believed to represent *Tetracheledone spinicirrus* from the coast of Uruguay. A preliminary study suggested the possibility that the specimens belonged to the genus *Thaumeledone* Robson, 1930. The type specimens of *Thaumeledone brevis* and *T. gunteri* were made available for study by the courtesy of J. F. Peake of the British Museum of Natural History.

Measurements and indices given in this paper have been defined by Voss (1963) with the exception of Hectocotylized Arm Index (HcAI) used here as the mantle length expressed as percentage of the hectocotylized arm length (MHI, of Pickford, 1964); and Fellow Arm Index (FAI), defined here as the hectocotylized arm length expressed as a percentage of the symmetrical fellow arm length (HAI, of Pickford, 1964). Scanning electron microscope photographs were taken by W. Charm, RSMAS. Abbreviations used are: USNM, United States National Museum of Natural History, Smithsonian Institution;

MORG, Museu Oceanografico de Rio Grande do Sul, Brazil; BMNH, British Museum of Natural History; UMML, University of Miami, Marine Laboratory.

Family OCTOPODIDAE Orbigny
Subfamily ELEDONINAE Gray
Vosseledone new genus

Diagnosis.—Octopod with uniserial suckers. Ink sac large superficially imbedded, evident externally. Radula degenerate with tall, recurved, simple rachidian tooth with narrow base; faint traces of first laterals; second laterals degenerate with proximal cusplless prominence; third laterals and marginal plates lacking. Third right arm hectocotylized with strong, well differentiated ligula; calamus deeply grooved. Arm heteromorphism absent. Digestive system with normal esophageal crop. Funnel organ V V type. Large eggs and spermatophores.

Type species.—*Vosseledone charrua* n. sp.

Vosseledone charrua new species
Figures 1-5; Tables 1-6

Charruan octopus. Pulpo charrua. Polvo charrua. *Tetracheledone spinicirrus*, Castellanos y Menni, 1968: 18; 1969: 73, 77 (*non Tetracheledone spinicirrus* Voss, 1955).

Material examined.—HOLOTYPE, one male, mantle length 49 mm. 35°14'S, 52°28'W, east of Punta del Este, Uruguay, in 200 m, USNM 729454. PARATYPES: 2 males, mantle lengths 50 and 53 mm, and one gravid female, mantle length 61 mm, collected with the holotype, UMML 1681. One male, mantle length 50 mm, and one gravid female, mantle length 58 mm, 33°17'S, 52°40'W, off Albardão, Rio Grande do Sul, in 100 m; collected by ALINE, October

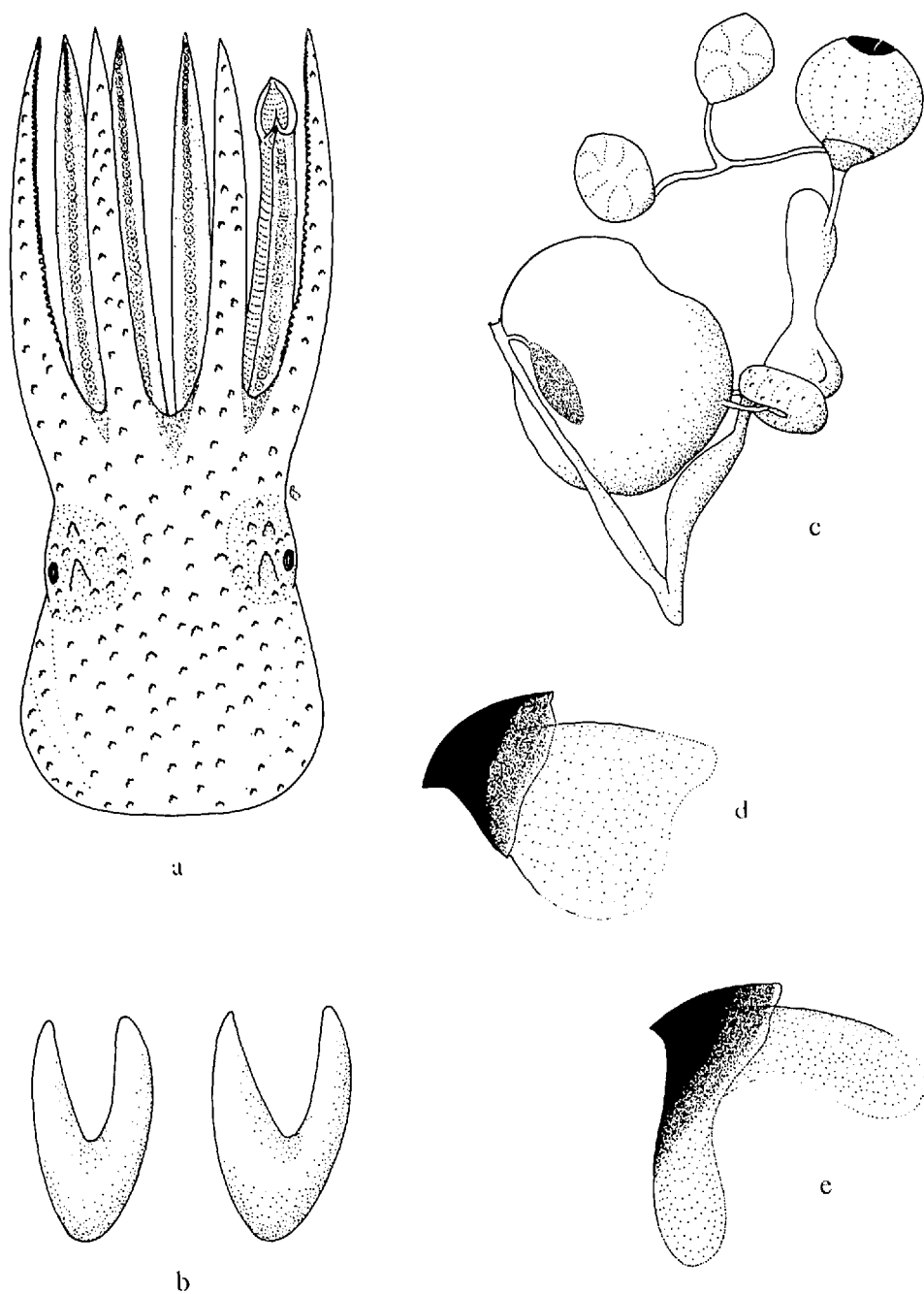


Figure 1. *Vosseledone charrua*, new genus and species: a, dorsal view of male; b, funnel organ; c, digestive system; d, upper mandible; e, lower mandible.

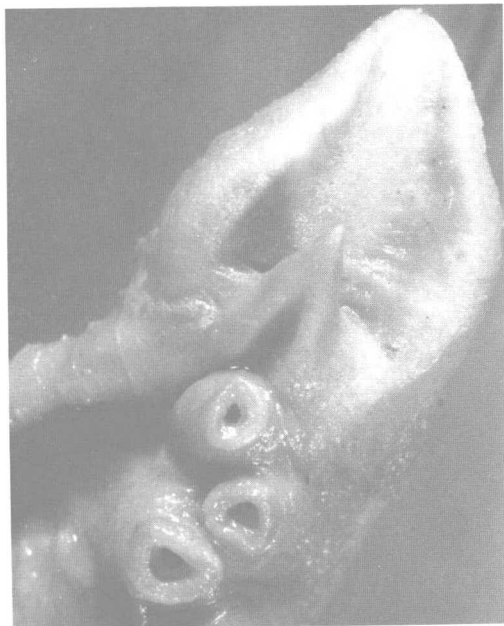


Figure 2. *Vosseledone charrua*, new genus and species. Male hectocotylus.

1970, USNM 729455. One female, mantle length 76.5 mm, from São Sebastião, São Paulo, in 10 m, collected by J. Ribeiro, 20 December 1945, MORG 10701.

Description.—*Vosseledone charrua* is a small octopod. The mantle is globular and wide, its length about one third of the total length. The mantle width is accentuated in gravid females. The head is not as wide as the mantle and the neck is not constricted. The eyes are prominent and occupy a large portion of the head area. The pallial aperture is wide.

The funnel is stout and muscular, free for about half of its length. The funnel organ consists of two thick V-shaped pads which are acute apically. The basal funnel flaps are strong and with the corresponding depressions of the mantle constitute a powerful mantle-locking apparatus.

The arms are strong, about twice as long as the mantle, with an ALI of 58–67 and an AWI of about 21. The arms are nearly equal in length and show no particular arm order. The suckers are uniserial, large,

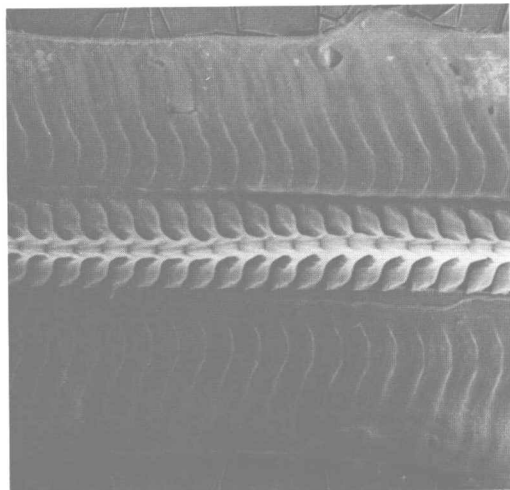


Figure 3. *Vosseledone charrua*, new genus and species. Radula.

erect and strong; they are largest near the edge of the web and minute distally. Almost half the suckers are found on the distal one fourth of the arm. The web is moderately deep with an average index of 34. Sector C is usually deepest; sector E is usually the shallowest.

The third right arm is hectocotylized; it is only slightly shorter than the corresponding left arm. The hectocotylus is muscular and massive with a ligula index of 8.4–11.1. The ligula is deeply excavated with few laminae; the lateral margins are strong and somewhat rolled inward. The calamus (Fig. 2) is large (CLI 43.1–58.8) and strong, deeply grooved, and very acute apically. The spermatophoral groove is prominent with a wide, strongly infolded membrane.

There are 6–7 gill filaments per outer demibranch. The digestive system of one male and one female were dissected. The beaks (Fig. 1d–e) offer no special characters. The radula is degenerate (Figs. 3–5), possessing a tall recurved and simple rachidian tooth with a narrow base. There are faint traces of first laterals. The second laterals are degenerate and exhibit a proximal prominence without a cusp. The third laterals and marginal plates are lacking.

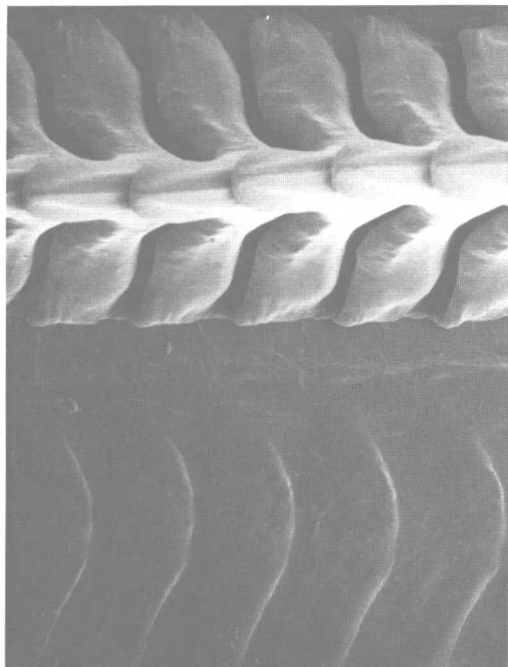


Figure 4. *Vosseledone charrua*, new genus and species. Detail of rachidian tooth and atrophied laterals.

The digestive tract is of the normal octopodan type. Anterior and posterior salivary glands are present. The esophagus is anteriorly expanded into a crop. The stomach is smaller than the spiral caecum. The surface of the latter has small protruding nodules which are probably the result of undetermined parasitic or bacterial infections. The caecum is followed by a large intestine which is recurved midway to its junction with the ink sac orifice in the anal region. The liver is large and ovoid; the pancreatic region is connected with the spiral caecum by paired hepatopancreatic ducts. The ink sac is large and fusiform, about half as long as the liver into which it is superficially imbedded but externally evident when the viscera are exposed.

Male and female reproductive systems were dissected. The penis is thick and tubular with a proximal, recurved divertic-

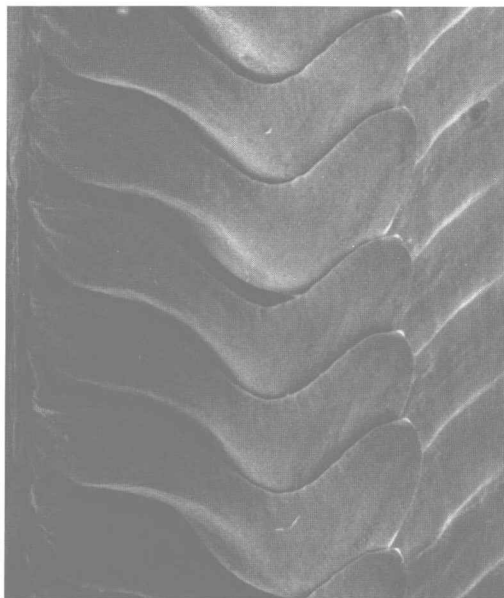


Figure 5. *Vosseledone charrua*, new genus and species. Lateral view of rachidian tooth.

ulum. Needham's sac contains a few (three in specimen No. 2) large spermatophores (Fig. 6a). These are long (SpLI 100–112) and slender (SpWI 5–8); the convoluted tube of the sperm receptacle occupies 36–42% of the tube length; the cylinder and cement body, about 20% and the ejaculatory apparatus is almost as long as the receptacle. The anterior third of the ejaculatory tube is arranged as a spiral band, the midportion resembles flakes disposed along a main axis and the oral segment is slightly spiraled.

The ovary is large with stout proximal oviducts. The ovary (Fig. 6c), of a gravid female (specimen No. 1), contained about 40 differentially developed, closely clustered, longitudinally striated eggs (Fig. 6d). The apparently mature eggs are about 13 mm by 4 mm with prominent stalks.

The sculpture, in preservation, of the dorsal surface of the mantle, head and arms, consists of numerous well-spaced, small papillose warts; some of these, irregularly distributed, are more minutely papil-

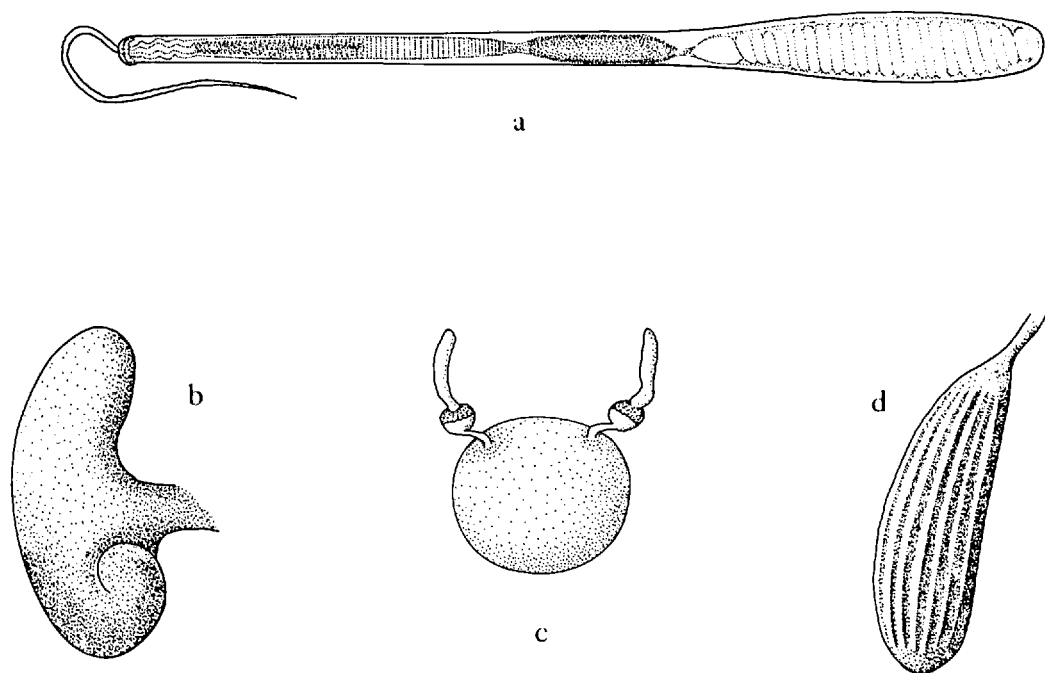


Figure 6. *Vosseledone charrua*, new genus and species: a, spermatophore; b, penis; c, female genitalia; d, egg.

lated than the others. The warts are less pronounced on the distal portion of the arms. Two prominent papillose cirri occur over the eye, of which the anterior is smaller. The eyelids are densely papillated. The ventral surface of the mantle, head and arms is smooth.

In preservation in isopropyl alcohol, the animals are of light flesh color.

Measurements and indices for the seven specimens are given in Tables 1 and 2.

Type.—USNM 729454, male, mantle length 49.0 mm.

Type locality.—35°14'S, 52°28'W, east of Punta del Este, Uruguay, in 200 m.

Discussion.—The new taxon described above cannot be placed in any of the known genera of the Octopodinae, Bathypolypodinae, and Eledoninae recognized by Robson (1932). The Bathypolypodinae was considered by Robson to include abyssal

octopods devoid of an ink sac and in which the esophageal crop is reduced or absent. This rules out the possibility of *Vosseledone* being congeneric with *Bathypolypus* Grimepe, 1921, *Graneledone* Joubin, 1918, *Thaumeledone* Robson, 1930, and *Bentheledone* Robson, 1932. In addition, the degenerate radula of *Vosseledone* is distinctly different from that of *Bathypolypus*, *Graneledone*, and *Bentheledone*, where the rachidian tooth is simple and the lateral teeth are well differentiated. The degenerate radula of *Thaumeledone brevis* (known in the literature from two small CHALLENGER specimens from off Montevideo), and *T. gunteri* (known from one small DISCOVERY female collected in the South Georgia Islands), suggested the possibility that the material under study might be conspecific with either of these species, more likely *T. brevis*, due to its geographical distribution. The possibility arose that because of the small size of the type specimens of *Thaumeledone*,

Table 1. Measurements (in mm) and counts of the holotype and six paratypes of *Vosseledone charrua* new species

	Holotype											
	1		2		3		4		5		6	
Sex	♀ G		♂		♀		♂		♂		♂	
Mantle Length	58.0		50.0		76.5		49.0		50.0		53.0	
Mantle Width	60.0		54.0		70.0		50.0		51.0		51.0	
Head Width	44.0		44.0		49.0		40.0		41.0		37.0	
Arm Length	I		L		R		L		R		L	
II	118.0		120.0		133.0		103.0		99.0		123.0	
III	113.0		78 +		135.5		100.0		47 +		120 +	
IV	93.0		123.0		135.5		86.0		72.0		98.0	
	125.0		120.5		130.0		97.0		96.0		130.0	
Hectocotylized												
Arm Length	---		77.0		---		86.0		72.0		98.0	
Ligula Length	---		6.5		---		8.5		8.0		10.0	
Calamus Length	---		2.8		---		5.0		4.0		5.1	
Penis Length	---		18.0		---		14.0		13.0		16.5	
Sucker Diameter	---		5.50		5.0		14.0		13.0		16.5	
Arm Width	6.0		10.0		13.5		12.0		10.5		12.5	
Gills	12.0		7		6		6		7		6	
Web Depth												
A	29.5		23.0		41.0		29.0		24.0		30.0	
B	32.5		34.0		48.0		34.0		30.0		34.0	
C	40.0		39.0		52.0		40.0		35.0		39.0	
D	41.0		41.0		45.0		39.0		34.0		30.0	
E	33.0		30.0		29.0		22.0		18.0		21.0	
Total Length	197.0		165.0		249.5		166.0		159.0		200.0	
Sperm Length			56.0				52.0					
Sperm Width			3.0				4.0					
Reservoir Length			21.0				22.0					

G = Gravid; + = Arm is broken.

Table 2. Indices of bodily proportions of 4 males and 3 females of *Vosseledone charrua* new species

Index	São Sebastião Brazil	Rio Grande do Sul Brazil	Uruguay	Range x
ML	76.5 N = 1	50.0– 58.0 N = 2	49.0– 61.0 N = 4	49.0–56.8– 76.5 N = 7
MWI	91.5	103.4–108.0	86.9–102.0	86.9–98.6–108.0
HWI	64.1	75.8– 88.0	57.4– 82.0	57.4–74.1– 88.0
ALI	58.3	62.4– 63.0	61.1– 67.5	58.3–63.0– 67.5
AWI	17.6	20.0– 20.6	18.8– 24.4	17.6–20.9– 24.4
MAI	52.6	47.2– 48.1	39.3– 51.7	39.3–47.7– 52.6
HcAI	---	64.9	54.1– 69.4	57.0–61.4– 69.4 N = 4
FAI	---	98.7	73.1– 86.0	73.1–85.4– 98.7
LLI	---	8.4	9.9– 11.1	8.4– 9.9– 11.1
CLI	---	43.1	50.0– 58.8	43.1–50.7– 58.8
PLI	---	36.0	26.0– 31.1	26.0–30.4– 36.0
SnDI	6.5	10.3– 11.0	9.0– 12.2	6.5– 9.8– 12.2 N = 7
WDI	35.7	33.3– 39.4	28.0– 36.4	28.0–33.9– 39.4
SpLI		112.0	100.6	
SpRI		36.1	42.3	
SpWI		5.3	8.1	

the ink sac, the lack of which is of generic significance, was either not well developed or had been undetected. Examination of the type material from the British Museum confirmed the fact that the ink sac was absent. Larger specimens collected by the ELTANIN in Antarctica being studied by G. L. Voss also lack ink sacs. The examination also revealed that the youngest of the two types of *Thaumeledone brevis*, listed as a female by both Hoyle (1885) and Robson (1932), was in fact a young male. The hectocotylus, however, is not well developed and the species awaits redescription by Voss.

Robson (1932) did not recognize the Eledoninae *sensu stricto* due to polyphyletic divergences of the subfamily's heterogeneous generic assemblage, and to his doubts about the validity of grouping them under the same subfamily in which only the suckers and the large egg size are common characters. This is in contrast to the evidence in favor of convergent evolution within the Bathypolypodinae. Robson believed that *Thaumeledone* belonged with the Bathypolypodinae and placed the remainder of the known genera in the Octopodinae, most of which have biserial suckers. The Eledoninae is a useful subfamily in which the

following genera are included: *Eledone* Leach, 1817; *Velodona* Chun, 1915; *Tetracheledone* Voss, 1955; *Pareledone* Robson, 1932; *Thaumeledone* Robson, 1930; *Granelledone* Joubin, 1918; and *Bentheledone* Robson, 1932.

Eledone presents heteromorphic arms, the tips of the non-hectocotylized male arms being modified into fleshy papillae or laminae; the hectocotylus is not differentiated into ligula and calamus. Both characters distinguish it from *Vosseledone*.

Velodona is characterized by a vestigial ink sac; the funnel organ has two very thick V-shaped pads; the ventral web of the dorsal arms is greatly expanded; the radula is simple with an unicuspid rachidian, the third lateral remarkably thick and short. The well developed ink sac and the degenerate radula of *Vosseledone* differentiates it from this genus.

In *Tetracheledone* the funnel organ characteristically is disposed in four parallel bars or pads; the hectocotylus is small but distinct and the radula is normal, well developed, with a simple rachidian. The double V funnel organ, the prominent hectocotylus, and the degenerate radula of *Vosseledone* distinguish it from this genus.

Taki (1961) created the Megaleledoninae

Table 3. Indices of bodily proportions of 4 males and 3 females of *Vosseledone charrua* new species, grouped by sexes

Index	Males		Females		Range $\bar{x}$		
ML	49.0–	50.5– 53.0	$N = 4$	58.0–65.2– 76.5	$N = 3$	49.0–56.8– 76.5	$N = 7$
MWI	96.2–	102.1–108.0		86.9–93.9–103.4		86.9–98.6–108.6	
HWI	69.8–	80.4– 88.0		57.4–65.8– 75.8		57.4–74.1– 88.0	
ALI	62.3–	64.8– 67.5		58.3–60.6– 62.4		58.3–63.0– 67.5	
AWI	20.0–	22.3– 24.4		17.6–19.0– 20.6		17.6–20.9– 24.4	
MAI	39.3–	60.8– 50.5		47.2–50.5– 52.6		39.3–47.7– 52.6	
SnDI	9.0–	10.7– 12.2		6.5– 8.6– 10.3		6.5– 9.8– 12.2	
WDI	28.9–	35.0– 39.4		28.0–32.3– 35.7		28.8–33.9– 39.4	

for *Megaleledone senoi*, from Antarctica; it was characterized by having a small "abortive" ink sac, but lacking an esophageal crop and by a small unicuspid radula. Voss (pers. comm.) considers it synonymous with *Pareledone*, based on his study of Antarctic octopods.

Vosseledone is closely related to *Pareledone* Robson, 1932. The generic diagnosis for the latter is brief: uniserial suckers, large eggs, normal hectocotylus and well developed ligula and calamus; restricted to the southern hemisphere. Having erected *Thaumeledone* for a form with a degenerate radula and lacking an ink sac, and *Benthaleledone* for a form lacking a crop and an ink sac, also possessing a peculiar radula, it is surprising that Robson did not mention any of these characters in his diagnosis of *Pareledone*. Based on the type species, the nominal species and material in the UMML collections, the diagnosis of *Pareledone* is expanded:

Octopods with uniserial suckers, ink sac well developed, deeply imbedded but externally visible; radula with unicuspid (tricuspid) or pentacuspis rachidian; three well defined lateral teeth, marginal plates usually present. Third right arm hectocotylized with well defined ligula and deeply grooved calamus. Normal crop present. Funnel organ of the V V or W type. Large eggs. Restricted to the southern hemisphere. Eurybathic.

All the nominal species of *Pareledone* have well differentiated radulae (Table 4).

The rachidian, in combination with one of the heteromorphic series of lateral teeth, is of taxonomic importance. The marked heterogeneity between the multicuspid heterodont radula of *Pareledone* and the degenerate radula of *Vosseledone* is considered to indicate a significant phylogenetic gap in maintaining a generic distinction.

Nixon (1969) showed that in *Octopus* the radula serves primarily for the physical transport of food and it seems likely that this is the case in most octopods. The same role was suggested for the radula of *Nautilus* by Griffin (1900). However, I find no evidence to support the view that the cephalopod radula represents a primary adaptive character or that its characteristics can be associated with any particular ecological adaptation. In my opinion, the radula should be regarded as a secondary adaptive character possibly resulting from a non-specific ecophysiological adaptation to biotic or abiotic environmental factors as suggested by Golikov (1973). Nevertheless, its complex heteromorphism in cephalopods expresses underlying genetic differences and similarities of high taxonomic value which are probably consistent with phylogenetic lineages.

In his discussion of the primitive or specialized condition of cephalopod radulae, Robson (1932) did not benefit from the more recent discovery of *Neopilina galathea*, the anatomy of which was described by Lemche and Wingstrand (1959). This Cambro-Devonian mollusc possesses a

Table 4. Characteristics of radulae of *Pareledone* spp.

<i>Pareledone</i>	Illustration	Rachidian	1st Lateral	2nd Lateral	3rd Lateral	Marginal Plate
<i>P. adelicana</i>	Berry, 1917 Fig. 13	Unicuspid	Small and triangular	Triangular, oblique cusp	Long, recurved	Not figured
<i>P. carlgreni</i>	Thore, 1945 Fig. 4	Pentacuspis*	Wide base and low cusp	Submarginal cusp	Normally recurved	Normal
<i>P. charcoti</i> †	Massy, 1916 Fig. 15	Pentacuspis*	Tall and narrow	Simple; narrow base and marginal cusp	Thick and straight	Normal
<i>P. harrisoni</i>	Berry, 1917 Fig. 13	Unicuspid	Small and triangular	Well developed with triangular, oblique cusp	Long, recurved	Not figured
<i>P. nigra</i>	Hoyle, 1910 Fig. 2	Pentacuspis*	Small and obtuse	Strongly triangular of rectangular base	Pronounced distal curvature	Long (Adam, 1941: 141)
<i>P. polymorpha</i>	Robson, 1930 Fig. 15	Unicuspid	Oblong base and blunt cusp	Narrow of shallow base with submarginal cusp	Small, curved thick, wide base	Not figured
<i>P. turqueti</i>	Massy, 1916 Fig. 27; Robson, 1932 Fig. 50	Pentacuspis*	Wide base with tall prominent distal cusp	Recurved base and submarginal cusp	More L-shaped than recurved	Normal
<i>P. umitakae</i>	Taki, 1961 Fig. 9-12	Unicuspid	Low triangular cusp	Low triangular cusp	Small, wide base, distal curvature	Absent

* Asymmetrical; † Type species.

Table 5. Characteristics of eledonine genera

Genus	Radula	Crop	Ink Sac	Funnel	Hectocotylus	Other
<i>Eledone</i>	Normal. Rachidian with variable symmetrical or asymmetrical cusps. Lateral teeth well defined. Marginal plates present.	Well developed	Deeply imbedded	W or V V	Undifferentiated	Heteromorphic male arm tips.
<i>Bentheledone</i>	Low unicuspid rachidian; reduced 1st and 2nd laterals, 3rd laterals L-shaped; well developed marginals.	Absent	Absent	Single V	---	Very small gills; 4-5 filaments.
<i>Graneledone</i>	Strong rachidian; 1st lateral slender, all laterals of narrow base; 2nd and 3rd laterals similarly triangular.	Reduced or absent	Absent	V V	Small; differentiated with a large calamus.	Penis with a large and saccular diverticle. Body covered by warts. Small gills.
<i>Pareledone</i>	Unicuspid rachidian, or asymmetrically pentacuspoid. Variable laterals (See Table 3).	Well developed	Deeply imbedded; entire periphery not externally visible in liver.	V V (W)	Well differentiated; of medium size occupying normal arm tip periphery. Deeply grooved calamus.	---
<i>Tetracheledone</i>	Unicuspid rachidian; cusps of 1st and 2nd laterals are triangular; mildly recurved 3rd lateral. Normal marginals.	Well developed	Superficially imbedded.	Four parallel pads	Differentiated; simple small calamus.	Typical sculpture.

Table 5. (Continued)

Genus	Radula	Crop	Ink Sac	Funnel	Hectocotylus	Other
<i>Thaumeledone</i>	Degenerate. Simple unicuspid rachidian; faint 1st lateral; 2nd lateral oblong with a low cusp.	Well developed	Absent	V V	----	The crop is not an oesophageal diverticle but a dilatation of it.
<i>Velodona</i>	Simple. Unicuspid rachidian. 3rd lateral thick and short.	Well developed	Degenerate	Very thick V V	Well developed	Ventral web of dorsal arms greatly expanded. No appendix in accessory gland of reproductive system.
<i>Vosseledone</i>	Degenerate. Vestigial 1st laterals; atrophied 2nd laterals. Marginal plates are lacking.	Well developed	Deeply imbedded. Large size. Entire periphery externally visible in liver cavity.	V V	Prominent and muscular. Strong and acute calamus with deep groove. Periphery exceeds normal arm tip outline. Strong velar membrane.	Typical sculpture.

Table 6. Synopsis of eledonine species with general geographic and vertical distribution

Species	Geographical Distribution	Approximate Vertical Distribution	Bottom Type
<i>Eledone carpati</i> Adam, 1950	West Africa	60–170 m	Dark ooze
<i>Eledone cirrhosa</i> (Lamarck, 1798)	N.E. Atlantic, Mediterranean	10–800 m	Muddy
<i>Eledone massyae</i> Voss, 1964	Patagonian	60–170 m	Muddy to calcareous
<i>Eledone moschata</i> (Lamarck, 1798)	Mediterranean, N.E. Atlantic	Usually not below 300 m	
<i>Eledone thysanophora</i> Voss, 1962	South Africa	Tide pools	
<i>Bentheledone albida</i> (Berry, 1917)	Antarctic	3,110 m	Thick ooze and rock
<i>Bentheledone rotunda</i> (Hoyle, 1885)	Kerguelen Is.-W. Australia	3,568–4,071 m	Diatom ooze
<i>Graneledone antarctica</i> Voss, 1976	Ross Sea	2,341 m	
<i>Graneledone challengerii</i> (Berry, 1916)	Kermadec Islands	1,153 m	
<i>Graneledone macrotyla</i> Voss, 1976	Falkland Islands	1,647–2,044 m	
<i>Graneledone verrucosa media</i> (Joubin, 1918)	North Western Atlantic	1,458 m	
<i>Graneledone verrucosa verrucosa</i> (Verrill, 1881)	North West Atlantic	2,300 m	
<i>Pareledone adelicana</i> (Berry, 1917)	Antarctica (Adelie coast)	300–549 m	Ooze
<i>Pareledone carlgreni</i> Thore, 1945	South Africa	----	
<i>Pareledone charcoti</i> (Joubin, 1905)	Antarctica. One record from Rio de Janeiro	0–1,500 m	Sandy bottom
<i>Pareledone harrisoni</i> (Berry, 1917)	Antarctica (Shackelton Ice Shelf)	24–595 m	Ooze
<i>Pareledone nigra</i> (Hoyle, 1910)	South West Africa		Shallow water rocks
<i>Pareledone polymorpha</i> (Robson, 1930)	South Georgia Islands	273 m	Mud
<i>Pareledone turqueti</i> (Joubin, 1905)	Antarctica. One record from Rio de Janeiro	549 m usually in depths not exceeding 4,000 m	
<i>Pareledone umitakae</i> Taki, 1961	Antarctica (Riiser-Larsen Pen.)	630–680 m	
<i>Tetracheledone spinicirrus</i> Voss, 1955	Gulf of Mexico, Florida, Cuba	183–544 m	
<i>Thaumeledone brevis</i> (Hoyle, 1885)	Uruguay	1,098 m	Green sand
<i>Thaumeledone gunteri</i> Robson, 1930	South Georgia Islands	400–410 m	
<i>Velodona togata capensis</i> Robson, 1929	South Africa (Natal)	402–457 m	
<i>Velodona togata togata</i> Chun, 1915	Tanzania	748 m	
<i>Vosseledone charrua</i> Palacio, 1978	Brazil-Uruguay	10–200 m	

radula with 11 longitudinal rows of teeth; the fourth lateral or comb-tooth is modified aborally by possessing about 40 denticles. A brief review of the radulae of some cephalopods reveals the following: the primitive *Nautilus* has 13 longitudinal rows of teeth with two strongly modified laterals (Vayssi re, 1896: pl. 18; Naef, 1923: pl. 25, Figs. 1-3; Robson, 1932: Fig. 3A; Solem and Richardson, 1975: Figs. 14-19); *Vampyroteuthis infernalis* has seven rows of well differentiated unicuspid homodont teeth (Berry, 1912: 273, Fig. 1; Pickford, 1949: Fig. 3; Solem and Roper, 1975: Figs. 15-18); *Argonauta* and *Ocythoe* possess seven rows of unicuspid teeth for the former and multicuspid teeth for the latter (Robson, 1932: Figs. 3D, 3F). Naef (1921) and later Aldrich et al. (1971), have shown that the Sepiolidae have unicuspid teeth and lack marginal plates; and that the Loliginidae and Ommastrephidae have tricuspid rachidians, bicuspid laterals and unicuspid inner and outer marginals. In the Octopodidae there is a trend towards reduction of the first lateral, and in deeper water forms there is a trend towards a unicuspid rachidian versus a multicuspid rachidian in shallow water forms. Evidently, primitive molluscs and cephalopods possess well differentiated and specialized radular teeth. In the modern octopods, however, there is an overall trend to a simplification of the radula. It is now possible to conclude that a complex radula constitutes a more primitive condition and that a more evolved and specialized condition is represented by a simple, strong and functional structure for the transport of food.

Most radulae illustrated in the literature are inadequately depicted (Aldrich et al., 1971), and radular orientation has lacked uniformity. This circumstance, in addition to my view that cephalopod radulae do not constitute a primary adaptive character, suggest that this structure has limited value in the study of octopodan speciation. Other structures, such as spermatophores, and the digestive and reproductive systems, will

probably offer us more sound bases for comparative studies.

A synopsis of eleledonine genera is presented in Table 5.

Etymology.—The new taxon is named in honor of G. L. Voss and N. A. Voss for their contributions to the advancement of Teuthology. The specific name is given after the Charrua Indians who inhabited Uruguay, Argentina, and Brazil; the name is indicative of the occurrence of the species.

ARTIFICIAL KEY TO THE GENERA WITH UNISERIAL SUCKERS OF OCTOPODIDAE

- 1a. Tips of the non-hectocotylized male arms modified into small fleshy papillae or laminae; hectocotylus not differentiated *Eledone*
- 1b. Tips of non-hectocotylized male arms with normal suckers; hectocotylus well differentiated into ligula and calamus 2
- 2a. Radula well differentiated into seven teeth 3
- 2b. Radula degenerate, lateral teeth atrophied 4
- 3a. Esophageal diverticle or crop well developed 5
- 3b. Esophageal diverticle or crop reduced, inconspicuous or absent *Graneledone*
- 4a. Ink sac well developed *Vosseledone* n. gen.
- 4b. Ink sac lacking *Thaumeledone*
- 5a. Funnel organ disposed in four parallel pads *Tetracheledone*
- 5b. Funnel organ V V or W 6
- 6a. Ink sac well developed, deeply imbedded *Pareledone*
- 6b. Ink sac degenerate or absent 7
- 7a. Esophageal diverticle or crop well developed; very thick V V funnel pads *Velodona*
- 7b. Esophagus lacks diverticle or crop; funnel consists of single, thick V *Bentheledone*

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